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POLISH CLEANING APPARATUS AND  
METHOD IN MANUFACTURE OF HGA

#### FIELD OF THE INVENTION

The present invention relates generally to a polish cleaning apparatus and a polish cleaning method used in the disk drive industry, and more specifically to  
10 a polish cleaning apparatus and a polish cleaning method adapted to be, used in the manufacture of a HGA (head gimbal assembly)

#### BACKGROUND OF THE INVENTION

As well known in that, thin film heads are used with data storage disks for  
15 reading or writing data on a recording layer of a disk. Typically, the head "flies" above the surface of the disk at a very low "altitude". The height of the air gap between the head and the disk is usually measured in fractions of micron so that an air bearing is formed.

20 For disks storing data using magnetic effects, the head usually includes an RF coil for transmitting and receiving a magnetic field to write and read in the recording layer. For disks storing data using optical effects, the head can include an objective lens to focus a light beam at the recording layer.

With low-flying heads, dust in the environment is a serious problem. Dust particles can cause catastrophic "head crashes" destroying the head and disk. Also, significant amounts of dust can accumulate on the head to interfere with  
5 the magnetic or optical effects.

Along with the evolution of the disk industry, the surface cleanliness of read-write heads has become one of the most critical concerns, because contaminants may cause a disk driver malfunction or even fail to spin up, while classical  
10 wash, rinse and dry technology using an aqueous chemical substance and ultrasonic agitation can not provide adequate cleaning efficiency for a head's ABS surface. The manufacturers are trying their best to seek more effective contamination removal methods to ensure that components and drives always remain as clean as possible.

15 US Patent No. 5,467,238 issued to Neville K. Lee et al on November 14, 1995, disclosed a cleaning apparatus for cleaning a read/write head used for accessing data stored on a recording disk of a disk drive. The cleaning apparatus comprises a mounting base positioned adjacent to the disk. The base includes a  
20 ratchet mechanism for rotating a cleaning pad mounted thereon. The mechanism is activated by a rotary or linear actuator arm for positioning the read/write head. The ratchet mechanism rotates the cleaning pad while the

actuator unloads the read/write head from the disk. A loading ramp is used to vertically position the read/write head relative to a cleaning surface of the cleaning pad.

5 However, since this conventional cleaning apparatus is more complicated in structure, lower in efficiency, and is used only after assembly of a disk drive, it is not suitable for mass production of the heads.

#### SUMMARY OF INVENTION

10 One object of the present invention is to provide a new kind of polish cleaning apparatus for cleaning heads of a HGA (head gimbal assembly) so that the problem of contamination of the heads by dusts or particulates can be completely overcome.

15 Another object of the present invention is to provide a polish cleaning method adapted to the apparatus.

In accordance with one aspect of the present invention, a polish cleaning apparatus for cleaning an HGA in a head comprises:

20 a frame;  
a plurality of carriers for locating and holding a plurality of HGAs, respectively, said HGAs having a face, a slider ABS surface, to be polished, directed

downwards;

a plurality of polish fingers under the carriers, fixed on a loading base;

a cloth attached to said polish fingers as a polish medium to provide a plurality of polish surfaces, on which the HGAs are polish cleaned;

5 a plurality of press-pins on each of the carriers, pressing on a HGA's flexure, respectively, to provide proper friction between the slider ABS surface and the polish surface.

According to another embodiment, a pneumatic cylinder unit is combined with the carriers and is controlled by a programmable controller, adapted to bring the 10 carriers, as well as the plurality of HGAs, to move back and forth in X and Y directions according to a customized program.

Also, a polish tank containing a cleaning solution, may be provided on the top of the frame, the solution is recirculated through a pump and a filter canister with an effective filter cartridge, and a thermostatically controlled strip heater 15 for heating the solution to a desired working temperature.

In accordance with another aspect of the present invention, a polish cleaning method adapted to the apparatus for cleaning a HGA (head gimble assembly) in a head , comprises the following steps:

20 precisely locating and holding a plurality of HGAs in a carrier, said HGAs having a face, a slider ABS surface, to be polished, directed downwards;

scrubbing off contaminants on the dirty slider surface being cleaned by a moving cloth strip , meanwhile smashes mass contaminants into tiny pieces;

5      getting the contaminants scrubbed off into a solution through solubilization, emulsification, etc. chemical action by a detergent, temperature, kind and concentration of the chemical substance of said solution are selected to achieve maximum cleaning effectiveness;

10     sufficiently agitating the solution to promote dissolution action by the motion of a cylinder unit;

15     filtering off the insoluble, suspended contaminants and particles in the solution by a filter canister in time so that the slider ABS surface will not be re-contaminated.

The polish cleaning apparatus and method of the present invention provides much higher cleaning efficiency for visible or invisible contaminants and particulates on a slider ABS surface. The apparatus and method of the invention

20    is so versatile and effective that they are suitable for the removal of dusts, oils, fingerprints, and other organic and inorganic contaminants in the form of both particulate and thin-film.

The above and other objects and advantages of the present invention will be described by way of preferred embodiments and with reference to the drawings, in which

5      Figure 1 is a top view of the polish cleaning apparatus of the present invention; Figure 2 is a perspective view of an HGA carrier positioned on polish fingers in the polish cleaning apparatus of the present invention; and Figure 3 is a diagram of water circulation of the polish cleaning apparatus.

10     PREFERRED EMBODIMENTS OF THE INVENTION

As shown in Figures 1-3, a polish cleaning apparatus of the invention mainly comprises four parts: polish fingers, HGA carriers, a cylinder motion unit and an immersion polish tank.

15    With reference to Figure 2, in polish cleaning units 1 and 8 provided are two rows of polish fingers 2 on which a kind of anti-static polyester cloth-strip is fixed smoothly by tension force to form a polish cleaning surface, and a plurality of HGAs 1 to be polished effectively are positioned on the polish cleaning surface.

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The HGA carriers are provided with a plurality of cylindrical pressing pins which press on a HGA's flexure, respectively. The HGA carriers hold a

plurality of HGA 1 to move back and forth according to a certain program for substantially simultaneously polish cleaning, and also provide precise locations for a plurality of HGA 1 by the co-ordination of the carriers and polish finger, see Figure 2.

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The cylinder motion units each comprise an X-cylinder 4, 5 and a Y-cylinder 3, 6, which move back and forth in X, or Y direction, respectively, according to a certain program customized in advance and bring HGA carriers as well as the plurality of HGA to move in both X and Y directions repeatedly.

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The HGA carriers holding the HGAs are immersed into the polish tank containing a solution so that the HGAs can be polished. The tank has an overflow weir, a pump, and a filter canister with a 0.2 micron filter cartridge for solution recirculating and filtering, and it also has a thermostatically-controlled strip heater to heat the solution to a proper working temperature.

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The polish cleaning method of the present invention is now explained. The polish is a contact-cleaning method using a kind of polyester cloth, which has good anti-static properties, less particle or particle-free, wear durability, as a  
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cleaning medium. When the polish cleaning apparatus is operated, the pneumatic cylinder unit brings the HGA being polished to move back and forth in both X and Y directions on the cloth-strip wrapped onto the polish fingers,

and then the slider ABS surface is polished and much higher cleaning efficiency (nearly 90%) can be achieved. Please refer to Figure 1. The cleaning function is derived from chemical and physical actions, as well as the polish cleaning. It includes three processes:

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**Cloth Scrubbing Action** is the first process, playing the most primary and important role in polish cleaning. In this process, the moving cloth strip scrubs off contaminants on the dirty slider surface being cleaned, meanwhile smashes mass contaminants into tiny pieces.

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**Detergent Dissolution Action** is the second process, in which contaminants scrubbed off get into solution through solubilization, emulsification, etc. chemical action by a detergent. It is similar to a conventional cleaning process: time, temperature, and kind and concentration of the detergent are the three important parameters in achieving maximum cleaning effectiveness. Meanwhile, motion of the cylinder provides sufficient agitation to promote dissolution action.

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20 **Filtration Action** is the third process in which the insoluble, suspended contaminants and particles in solution will be filtered off by a filter canister in time, or else, they may re-contaminate the products so that the latter must be cleaned again.

The HGA is a kind of precise component in a disk drive. The conventional ultrasonic cleaning can cause mechanical damage under high ultrasonic power, which limits its application, and can not provide an adequate cleaning effect.

5     However, the new polish cleaning technology can effectively clean the head and does not cause side effects for HGA performance. Basically, the polish cleaning can remove all kinds of contaminants such as dust, particles, film, etc. Its removal efficiency can achieve up to 95% for all kinds of contaminants whether it's organic or inorganic, while the classical ultrasonic cleaning does only about

10    60% for small particles and is not efficient for other kinds of contaminants.

While the present invention has been described by way of the preferred embodiments, the foregoing described is in all aspects illustrative, not restrictive. It is obvious to a person skilled in this art that numerous variations and modifications can be devised without departure from the scope of the

15    invention.